

Appendix D

**Field Screening Radiological Sample Data for
TSF-06 and TSF-26**

Appendix D

Field Screening Radiological Sample Data for TSF-06 and TSF-26

This appendix provides field screening radiological sample data that was collected during calendar year 2000 for TSF-06 and TSF-26 to support the remediation activities that were conducted during calendar year 2000 and to support future remediation decisions for these sites that are still necessary to meet the final remediation goal of 23.3 pCi/g Cs-137.

This appendix is a compilation of project emails and reports that were transmitted as attachments to those emails to provide the field screening radiological sample data that was collected.



Christophe P Oertel
04/19/2000 04:19 PM

To Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, Craig L Reese/ACR/CC01/INEEL/US@INEL, William P
Boyd/WPB/CC01/INEEL/US@INEL
cc Lori A Lopez/LW5/CC01/INEEL/US@INEL, Roger J Mockli/RM/CC01/INEEL/US@INEL, Raymond L
Sayer/RYS/CC01/INEEL/US@INEL

Subject WAG 1 TSF06 PRELIMINARY RESULTS

We have completed the activities required to draw some conclusions regarding the status of the TSF 06B roadbed site. First we would like to commend the field team personnel and the laborers for their hard work on this project. The abilities of everyone involved to stay focused and get this done during our short duration of good weather paid off. This project has been well organized and well executed.

The data is presented as a series of charts and maps.

The first chart shows two graphs. Graph 1 shows the Cs-137 concentration vs. depth based on the segmented core samples taken just north of the road berm. This area is primarily undisturbed native material with a top layer of windblown contamination. As you look at the graph, note how the Cs-137 data for the sampling locations decreases with depth below the surface. The shape of these curves is exponential in nature and this is very typical of winblown contamination which leaches slowly into the soil. The reason I point this out is that there was some discussion regarding the validity of sampling these points. As it turns out, this graph shows that these points can be used as a comparative reference for what other windblown contamination sites should resemble. If you look at the second graph, you see a difference. Here the samples are composites taken from various depths in the overburden material. The curves are somewhat exponential, but with one exception, are not near as pronounced. This is more typical of a "mixed distribution", that is one in which the Cs-137 is both windblown and the site has been disturbed somehow (remedial activities, etc.). So from these two graphs, we feel it is safe to state that the roadbed has contamination existing from the surface to 30 inches in some locations.

The second attachment is a layered series of concentration contours. When we looked at the roadbed, it became clear that getting any discrete samples (as a function of depth) was impossible in most locations. Roger made the excellent suggestion that we take composites over about 6 inch intervals until we encountered plastic or native soil. This attachment shows the Cs-137 sampling points at the 0-6 inch depth layer., the 12-18 in. layer, and the 24-30 in. layer. The posts on the maps are the sampling locations. Note on the top map that the highest Cs-137 concentrations extend over the middle third of the roadbed. That aligns perfectly with the third attachment which shows the 1-meter gamma spectrometry results.

The depth to plastic or native material is more difficult to quantify. It appears that the depth of this material varies from surface to about 30 inches with the 6-12 inch depth being most likely.

If there are any questions, please call.

chris oertel	stacey hill	mike evans
6-3541	6-3076	6-9791



tsf062 charts.xls

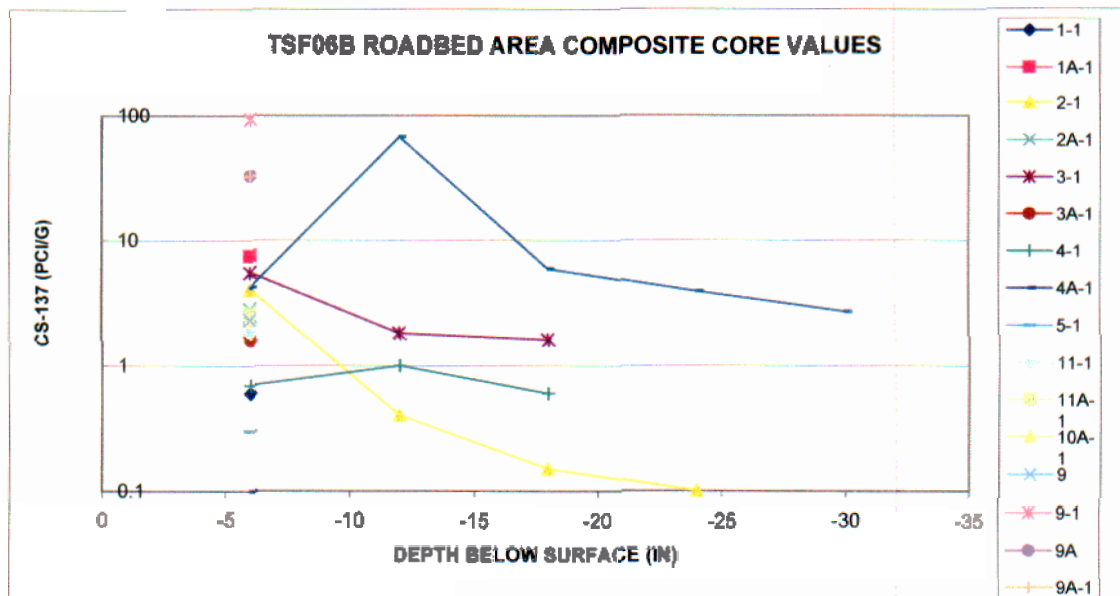
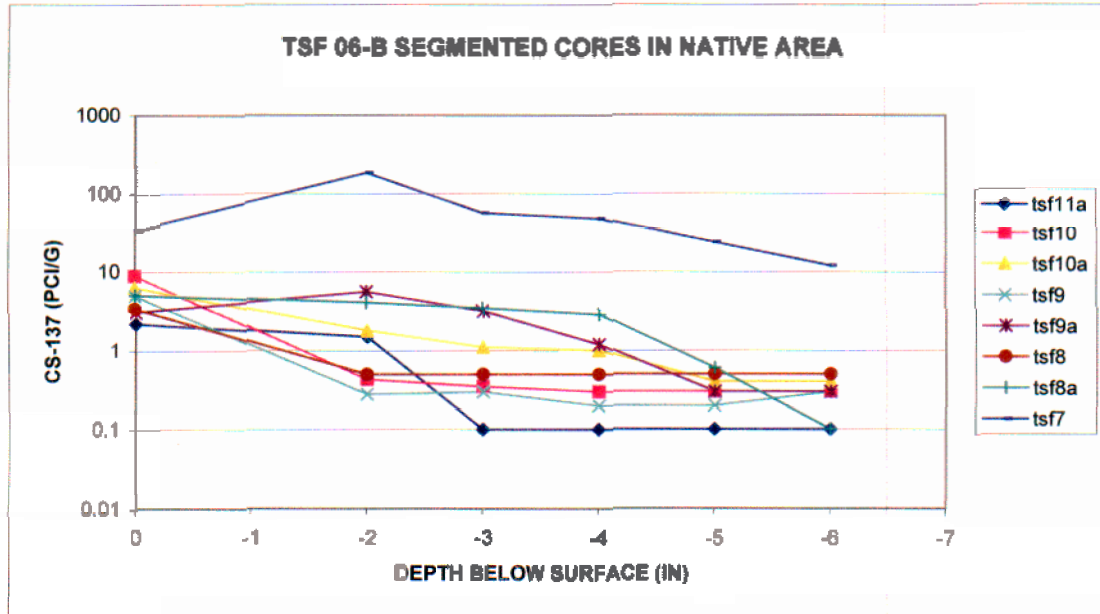


tsf06bcomposite#2.BM



tsf06insitu.BMP

WAG 1 TSF06B CS-137 DEPTH PROFILES FOR NORTH NATIVE AND ROADBED AREAS



WAG1 TSF08-B

CS-137 BY INSITU GAMMA SPEC

SURFACE READINGS ONLY

DISTANCES IN APPROX. FT.





Christophe P Oertel
05/03/2000 04:12 PM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL
cc: Michael L Evans/EVANML/CC01/INEEL/US@INEL

Subject: tsf 06 and pm2a status letter

attached please find the latest report on the measurements at WAG 1. If you have any questions, please feel free to call .

chris oertel



wag1_tsf06 and pm2a.doc

INTEROFFICE MEMORANDUM

Date: May 3, 2000

To: J. L. Hill MS 3932 6-3370
W.P. Boyd MS 3932 3-2936

From: C. P. Oertel MS 5202 6-3541
S. J. Hill MS 5202 6-3067
M. L. Evans MS 5202 6-9791

Subject: Results of WAG 1-TSF 06 and PM2A Radiation Profiling Measurements
CPO-06-00

Introduction:

We have completed first stage insitu gamma spectrometry and soil sampling efforts at the TSF -06 and PM2A areas at WAG 1. The insitu measurements were performed at TSF 06 using the DART/M1 gamma spectrometry system. These measurements were performed both to scope the potential Cs-137 levels at these sites and to ascertain the lateral extent of this contamination. In addition, segmented core sampling was performed at several locations in order to develop the depth profile for the Cs-137 at this site. At the PM2A area, six "hot spots" were sampled. Four spots were sampled using the segmented core samplers, and two were grab sampled.

InSitu Gamma Spectrometry Results:

Appendix 1 shows the results of one-meter measurements at the TSF 06 area. The Cs-137 values are reported in pCi/g and the uncertainties are at the 1-sigma level. The data is mapped on as shown below in figure 1:

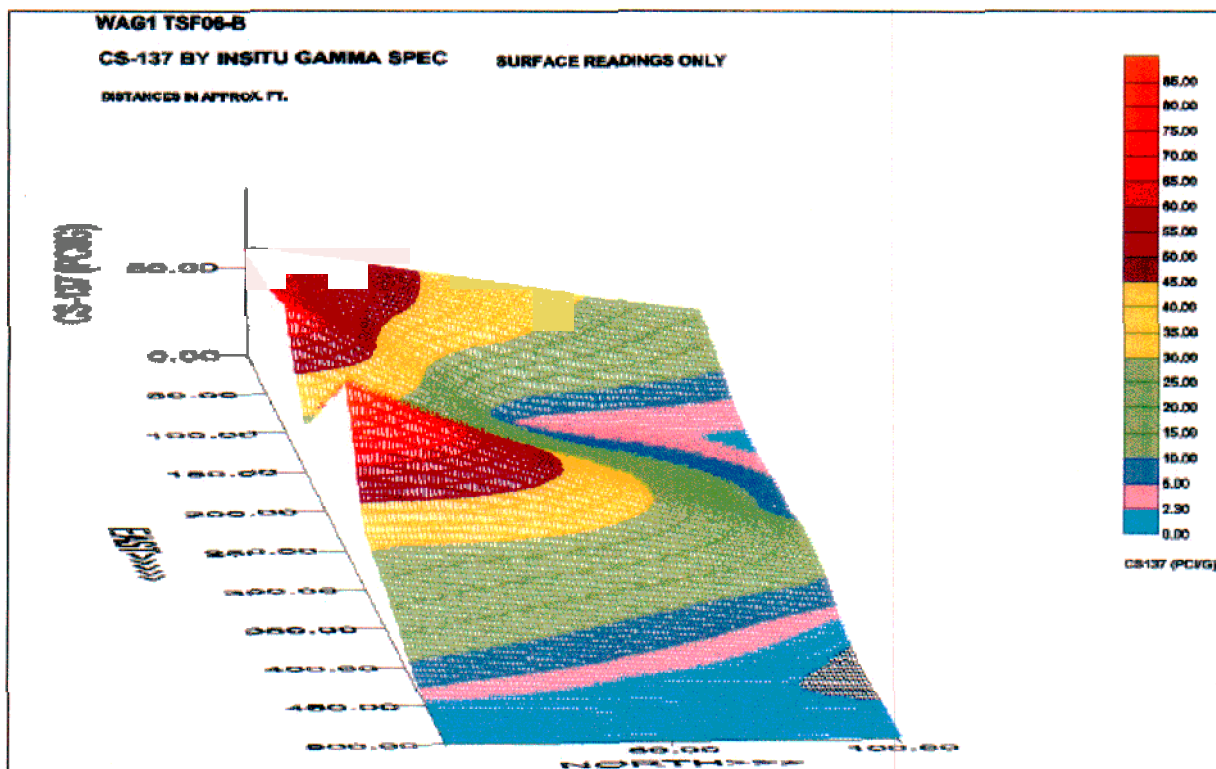


Figure 1:Cs-137 profile at WAG 1-TSF 06 area

Notice that the areas of elevated Cs-137 occur north of dirt piles in the PM2A area known to have high Cs-137 contamination. In essence, the piles are a source of windblown contamination for the TSF-06 site. It has been established that these piles are to be bagged and removed prior to any remediation efforts at the TSF-06 site.

In order to establish the Cs-17 depth profile at the TSF-06 site, two sets of samples were taken and analyzed. The first set consisted of segmented core samples taken in the area immediately north of the "berm" of the roadbed. This area is known to be native and relatively undisturbed. It is subject to the same source of windblown contamination from the PM2A site. These samples were acquired using a stainless steel sampling tool specially designed to sample at discrete one inch increments without cross contaminating various layers. The samples were collected and placed in plastic sample containers and then analyzed for Cs-137 concentrations using a fully calibrated, NIST-traceable gamma spectrometry system at INTEC. The Cs-137 data are shown in appendix 2 and are plotted below in figure2:

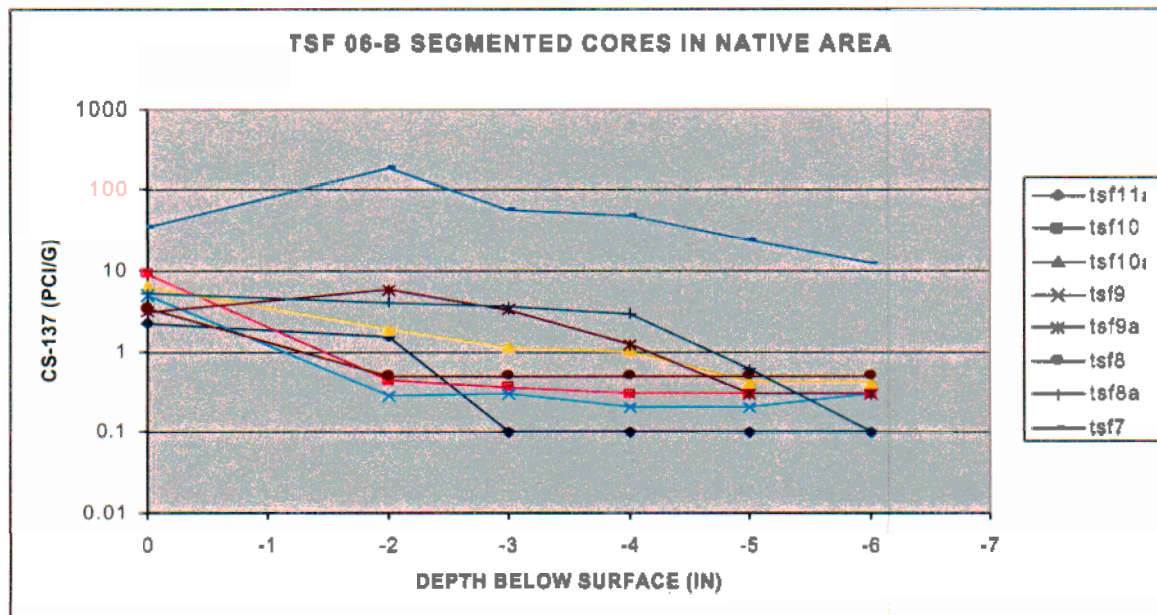


Figure 2: WAG 1 Cs-137 Profile in native area

In addition, composite depth samples were taken and analyzed in identical fashion at several sites on the actual roadbed. This data is shown in Appendix 3 and in figure 3 below:

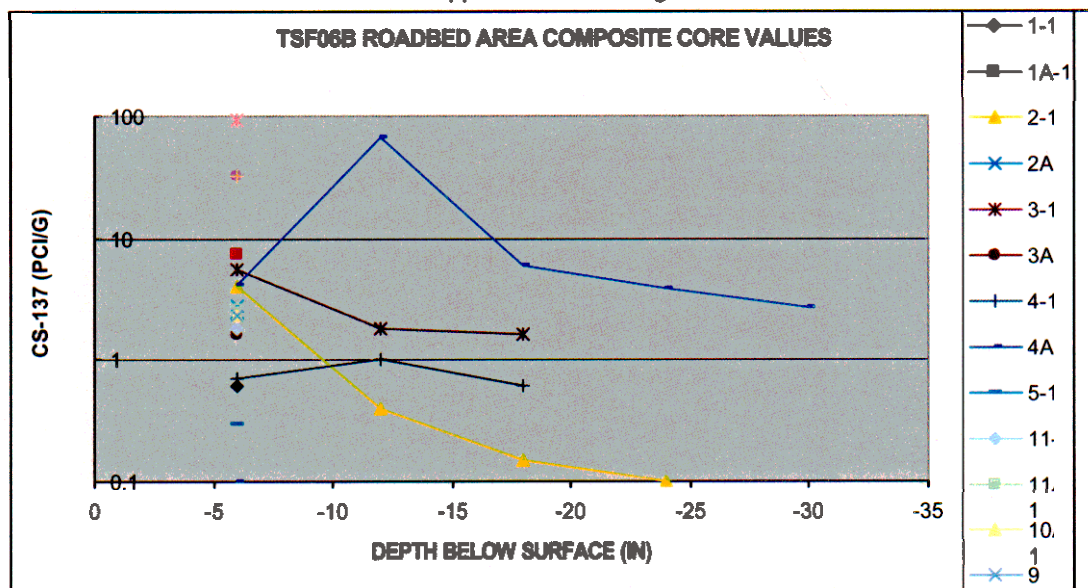


Figure 3: WAG 1 T^SF06B Roadbed Cs-137 Profile

Note that in both figures 2 and 3 the general trend or profile for the Cs-137 is exponential with depth. This is very typical of windblown contamination onto a site followed by normal leaching. The Cs-137 profile in the roadbed indicates that this roadbed area has not been disturbed recently.

Samples were taken in the PM2A area also. This was done in order to establish an approximate depth profile for this area and to establish a location where bagged soil from the "hot piles" could be placed. The data is shown in appendix 4 and in the figure below:

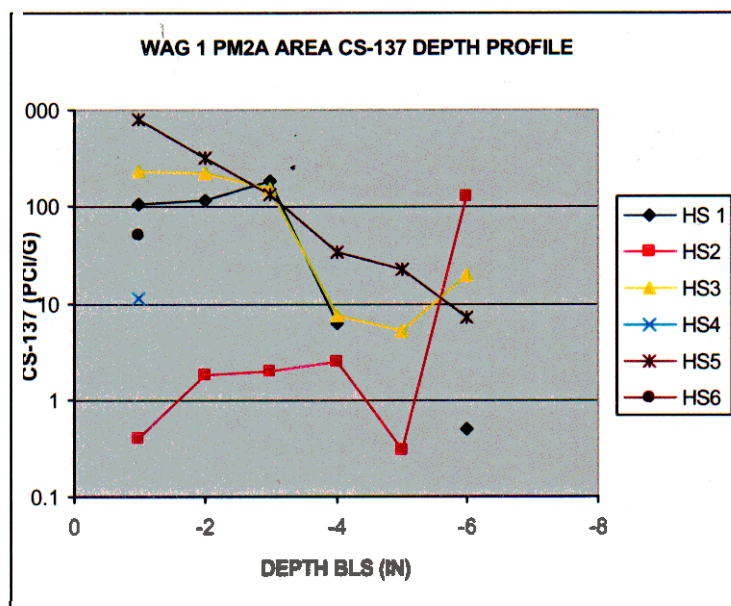


Figure 4: Cs-137 Profile in PM2A area

J. L. Hill
W.P. Boyd
May 2, 2000
CPO-06-00
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The figure 4 data shows generally the same trend as the previous figures except for hot spot 2. The increase in Cs-137 at this spot is due either to disturbance or simply to a hotspot at depth. In any case, the levels of Cs-137 at all of these points are considerably higher than those at TSF06.

This letter will be followed by subsequent communications as work at this WAG continues. If there are any questions, please call us.

APPENDIX 1: INSITU GAMMA SPECTROMETRY VALUES AT TSF06

LOCATION	EAST	NORTH	INSITU	ERR
			HpGe	
1	1	1	59.9	0.6
1-1	1	12	4.8	0.1
1A	50	1	65.4	0.7
1A-1	50	12	2.5	0.1
2	100	1	74.3	1
2-1	100	12	2.1	0.1
2A	150	1	26.4	0.6
2A-1	150	12	5.9	0.2
3	200	1	62	0.9
3-1	200	12	11	0.3
3A	250	1	96.4	1.2
3A-1	250	12	12.8	0.3
4	300	1	33.6	0.7
4-1	300	12	10	0.3
4A	350	1	24.1	0.6
4A-1	350	12	0.1	0.1
5	400	1	13.2	0.3
5-1	400	12	0.3	0.3
5A	450	1	2.2	0.1
5A-1	450	12	0.3	0.3
6	500	1	1.8	0.1
6-1	500	12	0.2	0.2
N30E405	425	50	1.7	0.1
12	500	100	1.8	0.1
12-1	500	95	4.2	0.2
12A	475	100	1.3	0.1
11	375	100	0.1	0.05
11-1	375	95	2.2	0.1
11A	350	100	2.2	0.1
11A-1	350	95	0.1	0.1
10	325	100	8.9	0.3
10-1	325	95	29.4	0.5
10A	225	100	6.3	0.2
10A-1	225	95	5.5	0.2
9	175	100	5	0.2
9-1	175	95	10.8	0.3
9A	150	100	3.1	0.2
9A-1	150	95	25.9	0.4
8	100	100	3.4	0.2
8-1	100	95	6.6	0.2
N30E75	100	50	4.1	1.8
8A	75	100	5.1	0.2
8A-1	75	95	3.3	0.2
TSF06NW	25	100	15.5	0.3
7A	75	50	14.7	0.3
7	50	50	34	0.5

J. L. Hill
W.P.Boyd
May 2, 2000
CPO-06-00
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APPENDIX 2: CS-137 SEGMENTED CORE DATA FROM WAG1 TSF06 NATIVE AREA

**SEGMENTED CORE SAMPLES,
DEPTH PROFILE**

all values Cs-137 in pCi/g			samples taken in "native" area						
DEPTH	BLS	tsf11a	tsf10	Tsf10a	tsf9	tsf9a	tsf8	tsf8a	tsf7
0		2.2	8.9	6.3		5	3.1	3.4	5.1
-2		1.5	0.43	1.8	0.28		5.6	0.5	4.1
-3		0.1	0.35	1.1	0.3		3.2	0.5	3.5
-4		0.1	0.3	1	0.2		1.2	0.5	2.9
-5		0.1	0.3	0.4	0.2		0.3	0.5	0.6
-6		0.1	0.3	0.4	0.3		0.3	0.5	0.1

J. L. Hill
W.P.Boyd
May 2, 2000
CPO-06-00
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APPENDIX 3: CS-137 COMPOSITE CORE DATA FROM TSF06 ROADBED

max depth	1-1	1A-1	2-1	2A-1	3-1	3A-1	4-1	4A-1	5-1	11-1	11A-1	10A-1	9	9-1	9A	9A-1	8-1	8A-1
-6	0.6	7.5	4	2.8	5.5	1.6	0.7	0	2.2	1.8	2.6	2.3	2.3	93.2	32.9	32.9	4.2	0.3
-12			0.4		1.8		1										67.6	
-18			0.15		1.6		0.6										5.9	
-24			0.1														3.9	
-30																	2.7	

J. L. Hill
W.P.Boyd
May 2, 2000
CPO-06-00
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APPENDIX 4: PM2A CS-137 VALUES

PM2A AREA GENERAL DEPTH PROFILE DATA							
CS137 IN PCI/GRAM							
DEPTH BLS	HS 1	HS2	HS3	HS4	HS5	HS6	
-1	104	0.4	229	11	808	50	
-2	118	1.8	216		315		
-3	184	2	152		131		
-4	6.1	2.5	7.4		33.1		
-5		0.3	5.1		22.6		
-6	0.5	125	19.5		7		



Christophe P Oertel
05/09/2000 02:36 PM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL
cc:

Subject: TSF 06 roadbed graph

Janet/Pat--

attached is the roadbed plot for the 0-6 inch depth range at TSF 06. The map is pretty self explanatory.
Do you want this with the actual surveyed coordinates or is this adequate?

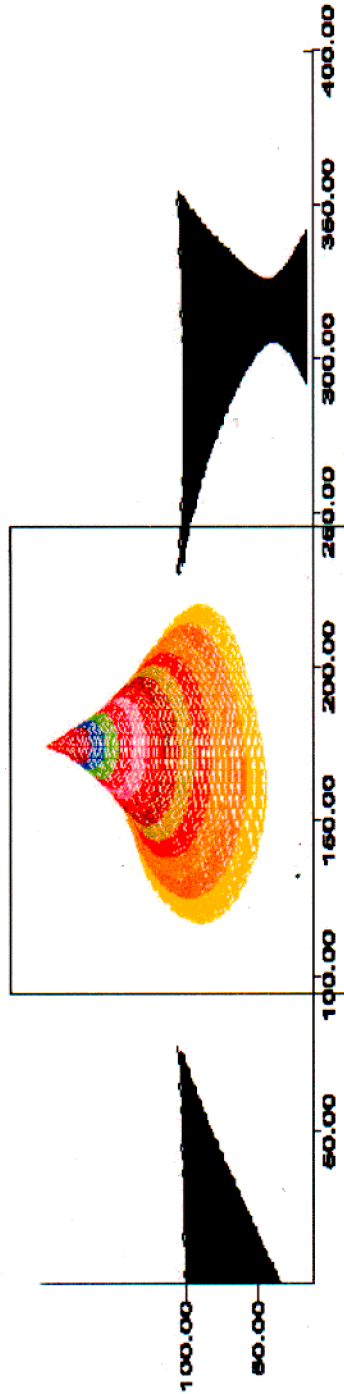
chris



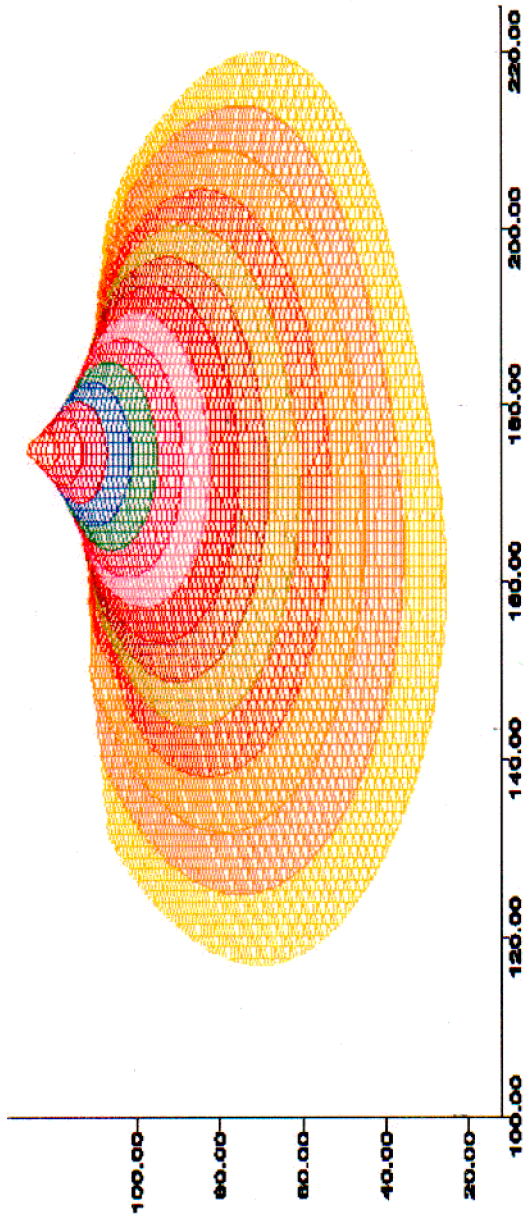
tsf06road.BMP

WAG 1 TSF 06 ROADBED AREA

0-6 INCH SAMPLE DATA



EXPLODED VIEW OF AREA > 20 pCi/g





Christophe P Oertel
05/11/2000 11:02 AM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL
cc:

Subject: New TSF 06 Maps

Per our meeting on Monday, we have regraphed the TSF06 roadbed area using the actual coordinates. Note that the first attached map is the insitu data, and the second is the 0-6 inch composite data with Cs-137 vlaues >20 pCi/g. Note that the software smooths or extrapolates the grids together rather than making them discreet. That is not a big deal in my opinion (unless you have laser guided, GPS based scrapers and front end loaders!!). Anyway, hope these are ok.

Second, I have checked around regarding soil binders, etc. for the PM2a. This is a little out of my field, but Stacey and I did observe the application of the geomembrane/Stonehard system to the area north of the tank farm yesterday. In talking with Jody Landis and Michelle Kaptein, we found out that this system completely binds the soil and is largely water impermeable. It is probably overkill for the PM2A in terms of effect and cost. Michelle suggested looking into something called RoadOyl which she and Peggy (?) had investigated and which has been used at other sites. The issue that is technically difficult is how long the soil binder will hold the soil before it degrades and blows away. Also, most of these products cannot be mechanically perturbed (i.e. walked or driven on) at all. So, Pat---can you tell me about what time frame you would need this stuff to last for? I also found out that most of these types of products will meed convetional waste disposal criteria here or anywhere else. I will continue investigating.

Third--I talked to Lori yesterday. This weather is not helping us. Pat, I am a little (just a little) concerned about the measurement schedule. Can you guys have Ray or someone get us a new batch of pinflags and also a vehicle set up for Tuesday---Wed--thursday next week? Stacey and I would like to hit that area quickly if weather permits.

Fourth--Janet--I talked with the people who built the SAM 935 regarding the very large detector we have. I believe that Kelly Wright ordered this instrument with the very best of intentions, however the detector he ordered is too big for general field work. I would suggest replacing it with a smaller one which is internally shielded to reduce shine effects. BNC has one available at \$1500 for the detector and \$1570 for the associated analysis software. Should/can I buy it for the PM2a and other survey work? Let me know and if yes, I will submit a requisition. We can have these items in 2 weeks.

Call if you guys have questions, and hope for dry weather!!

chris and stacey



tsf06insitu.BMP

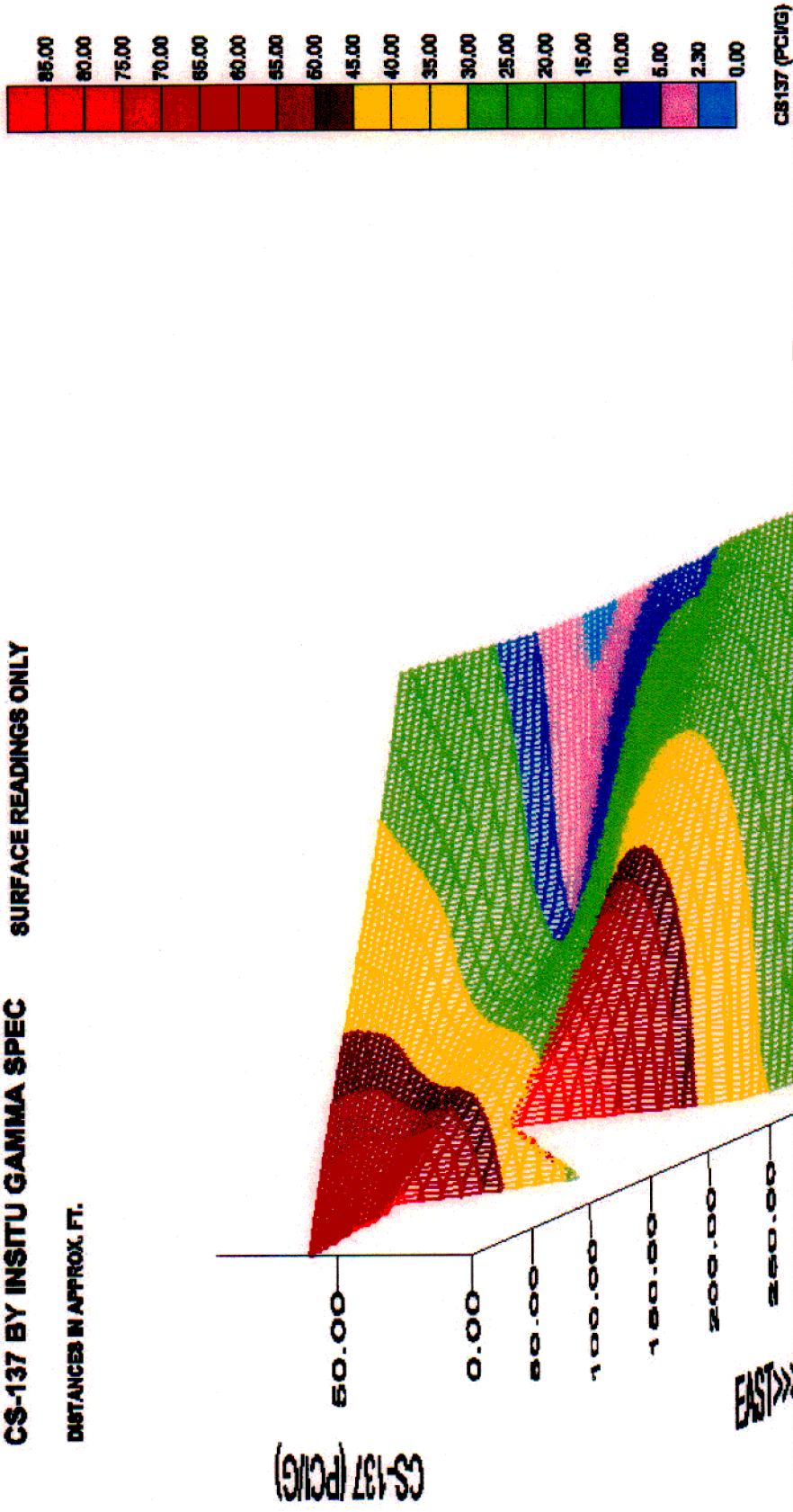


WAG1 TSF08-B

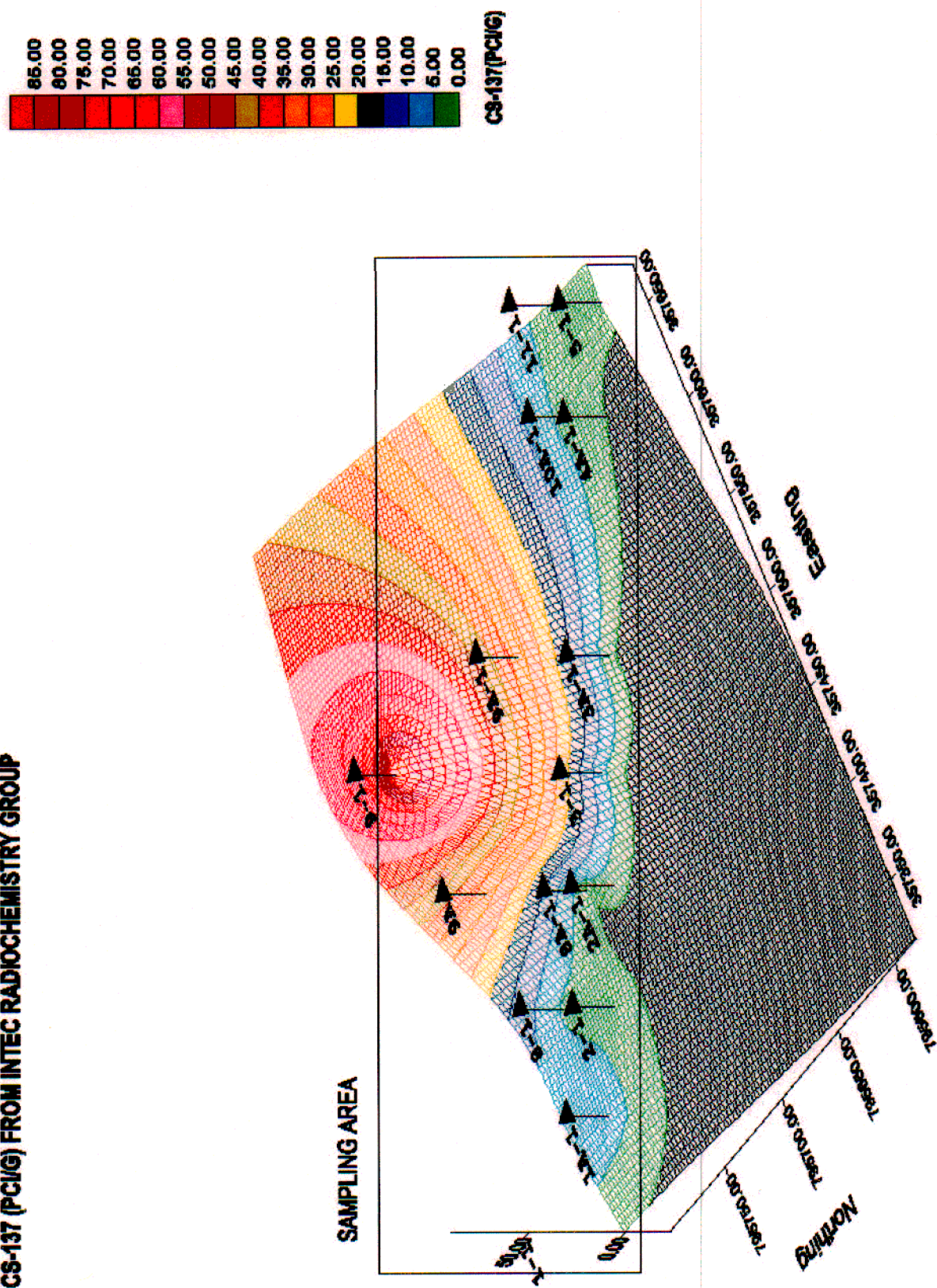
CS-137 BY INSITU GAMMA SPEC

SURFACE READINGS ONLY

DISTANCES IN APPROX. FT.



**WAG 1 TSF06 0-6 INCH COMPOSITE SAMPLING AREA
CS-137 (PCU/G) FROM INTEC RADIOCHEMISTRY GROUP**





Christophe P Oertel
05/18/2000 08:37 AM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL
cc:

Subject: TSF06 Excavation Map

Janet-Pat--

Bob, Dan, and I met briefly yesterday and consolidated our information on the excavation boundary for the TSF 06B. The attached map shows the boundaries and the coordinates.

Bob and Dan will survey in this area soon.

We will attempt to get to PM2A today and begin DART and SAM 935 measurements at bottom of piles. Currently, the radio shop is working on the truck for us.

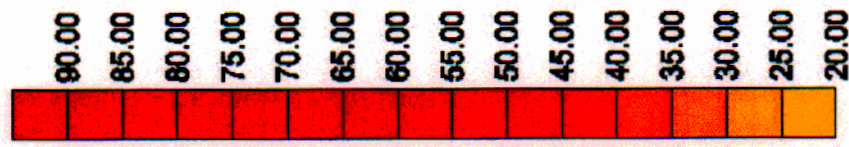
regards

chris and stacey

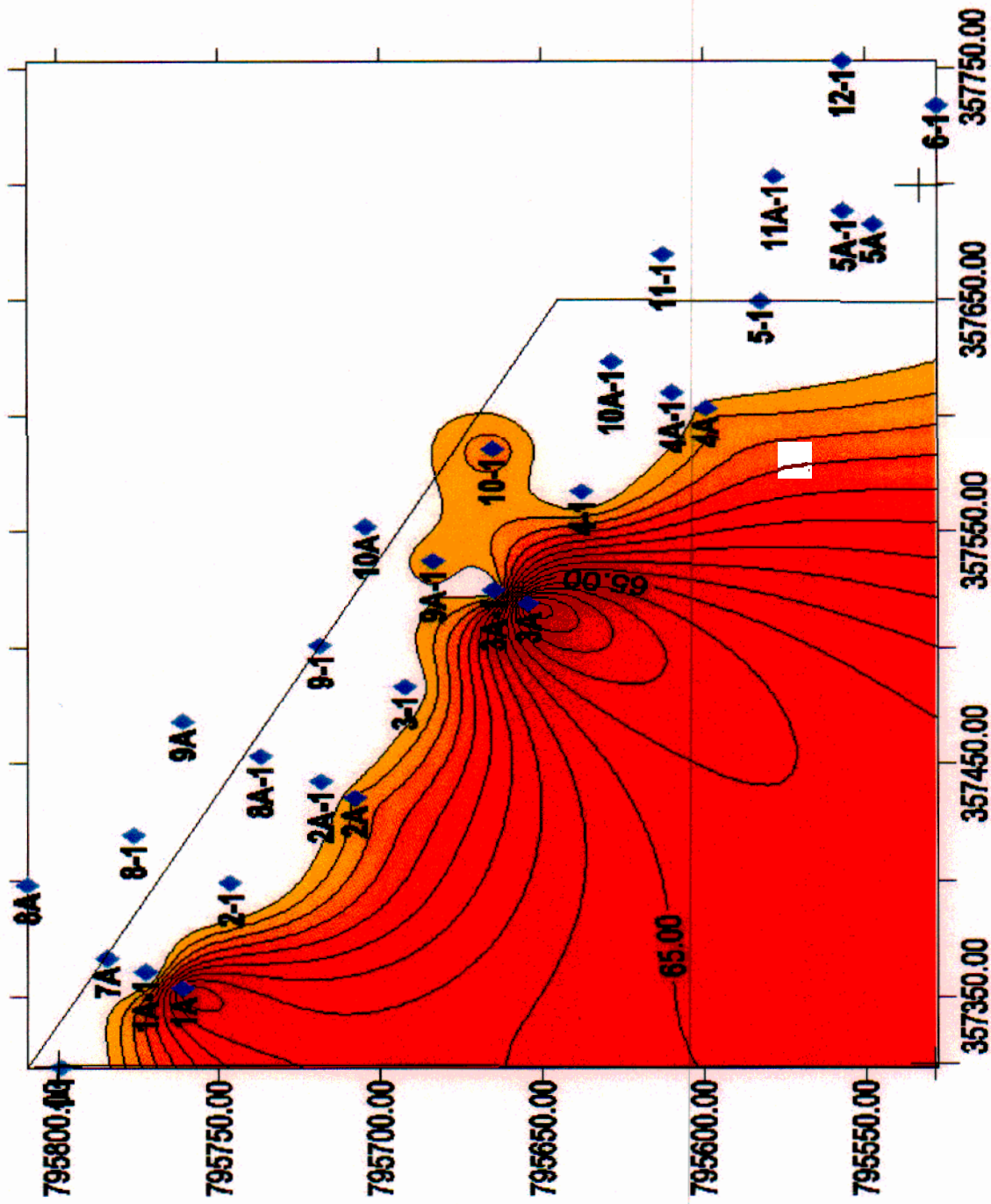


tsf06excav.BMP

WAG 1 TSF 06 PROPOSED EXCAVATION LOCATIONS



CS137 PC/JG





Christophe P Oertel
05/24/2000 08:01 AM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL, Stacey J Hill/HILLSJ/CC01/INEEL/US@INEL
cc:

Subject: PMA 2A Piles

We have completed the basic measurements of the 3 piles in the PM2A area. The results are attached. On May 19 we measured the center and corners of Pile 1 by insitu spectrometry and by gathering surface samples. The data show very good internal consistency except for the point on the south corner which is considerably higher in Cs-137 than the others. This point was influenced by shine from the #2 pile and from some random hot spots uncovered during excavation. The center grab sample from pile 1 is likely a hot particle or particles. On 5-19 we also measured the Pile 1 area and the data there is almost vectored, i.e. directionalized toward pile 2. Note the big differences between the insitu and grab sample values. This data is a clear indicator of the effects of shine from pile #2 and how it affects the above ground insitu measurements. On 5-23 Stacey performed a difficult series of measurements on pile 2. These measurements were done with and without lead collimation and with and without the pile 2 soil bag present. Note the internal consistency of the collimated measurements with or without the presence of the soil bag. The point is that the collimation appears to be adequate for shielding the effects of the Cs-137. We should be able to collimate reasonable well in the presence of the soil bags. I would suggest that we also pull some surface grabs and measure the Cs-137 to assess the effects of the collimation.

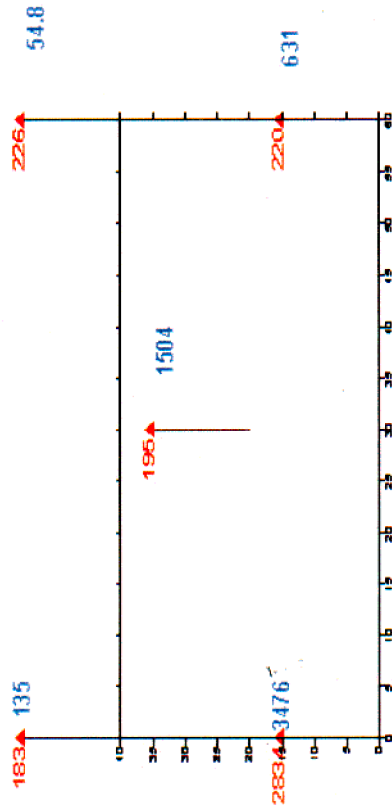
We can start the general area survey either thursday or monday (TBD. any questions, please call.

chris and stacey



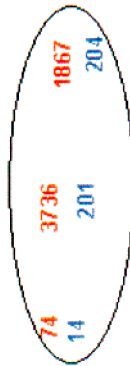
pm2apiles.bmp

WAG1 PM2A SOIL PILE DATA



PILE #3 AREA 5.19.2000

NOT MEASUREABLE @SURFACE
 1157 2 FT. BLS COLLIMATED W/BAG
 1462 2 FT. BLS COLLIMATED W/O BAG
 1295 2 FT. BLS @1M COLLIMATED W/O BAG



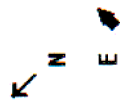
PILE #1 AREA 5.19.2000

736 -1M NO COLLIMATION

175

36.3

PILE #2 AREA 5.23.2000



RED VALUES ARE CS137 (PC/G) BY INSITU GAMMA SPECTROMETRY

BLUE VALUES ARE CS-137 (PC/G) FROM SURFACE GRABS



Christophe P Oertel
06/27/2000 04:10 PM

To: Janet L Hill/HILLJL2/CC01/INEEL/US@INEL, William P Boyd/WPB/CC01/INEEL/US@INEL
cc: Lori A Lopez/LW5/CC01/INEEL/US@INEL, Roger J Mockli/RMI/CC01/INEEL/US@INEL

Subject: PM2A report

Janet/Pat

attached is the PM2A report. If you have any questions, please contact us at 6-3541,6-3067,or 6-9791



wag1_pm2a.doc

INTEROFFICE MEMORANDUM

Date: June 27, 2000

To: J. L. Hill MS 3932 6-3370
W.P. Boyd MS 3932 3-2936

From: C. P. Oertel MS 5202 6-3541
S. J. Hill MS 5202 6-3067
M. L. Evans MS 5202 6-9791

Subject: Results of WAG 1- PM2A Radiation Profiling Measurements
CPO-08-00

Introduction:

We have completed first stage gross gamma, insitu gamma spectrometry, and soil grab sampling efforts at the PM2A area at WAG 1. The gross gamma data was acquired with the handheld SAM-935 sodium iodide detector. The insitu measurements were performed at PM2A using the DART/M1 gamma spectrometry system. Grab samples were collected at each measurement point using a spoon sampler. These measurements were performed both to scope the potential Cs-137 levels at this site and to ascertain the lateral extent of this contamination. In addition, surface grab sampling was performed at all measurement locations. Measurement points were located about 50 feet apart and covered the entire fenced area. Figure 1 shows the measurement and sampling locations at the PM2A area.

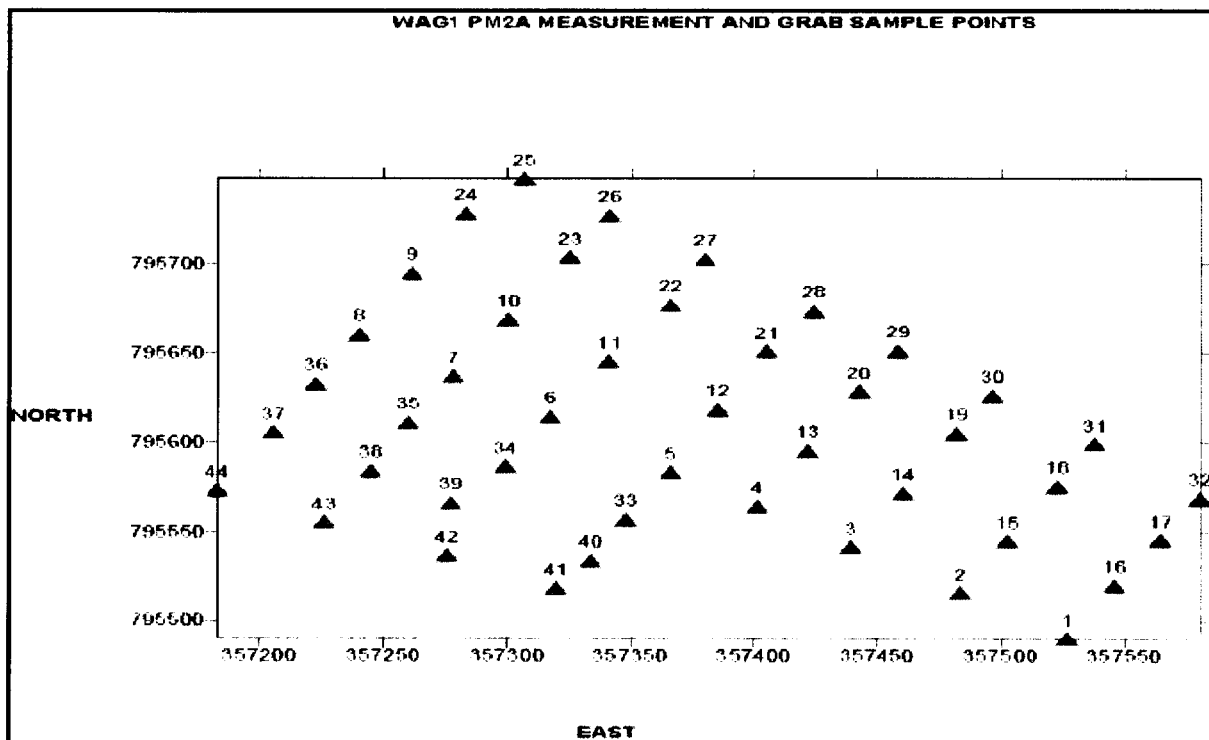


Figure 1: Sampling and one meter measurement locations at PM2A site

Gross Gamma Counting Results:

The portable SAM-935 sodium iodide detector was used to prescan and locate areas of high count rate. These measurements were performed by holding the detector at one foot above ground for 60 seconds at each measurement point. In addition, several other points were measured between the points shown in figure one in order to get better measurement resolution. Appendix 1 and figure 2 below show the results of the SAM 935 measurements.

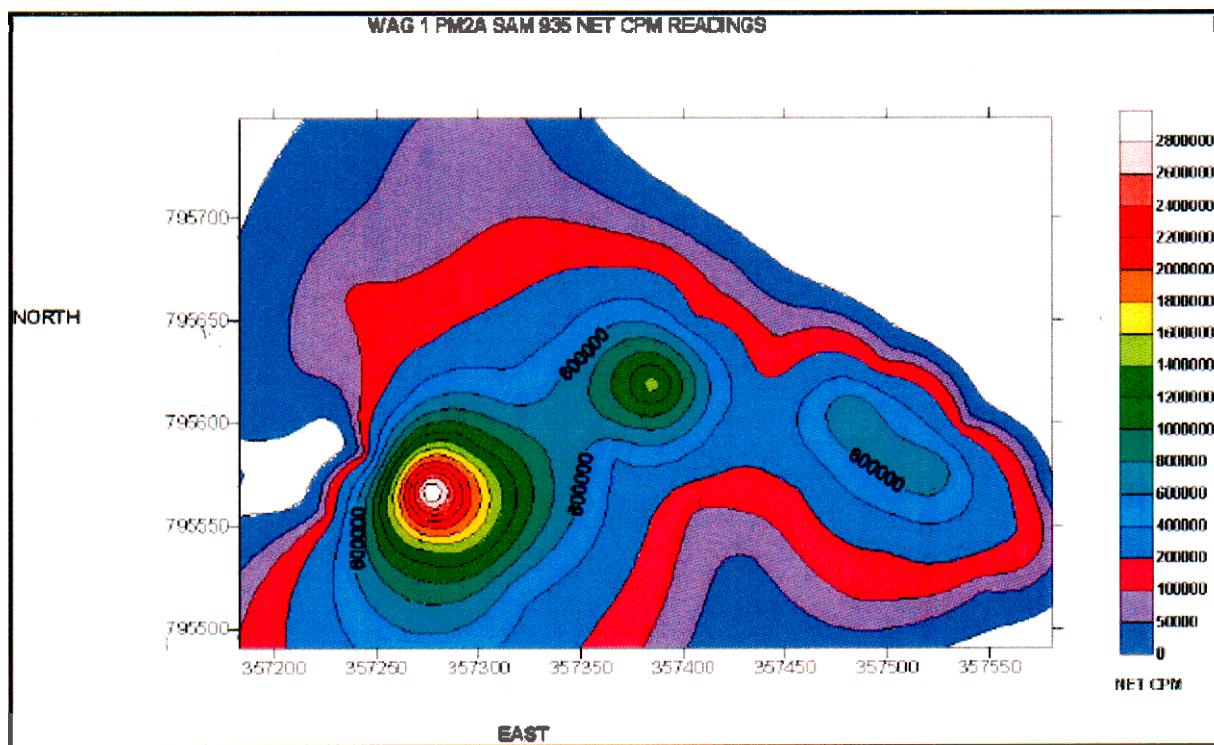


Figure 2: SAM 935 Gross gamma count results at PM2A

InSitu Gamma Spectrometry Results:

The system employs a standard coaxial germanium detector positioned at one meter above ground and connected to an EG&G Ortec Dart multichannel analyzer. The multichannel analyzer is connected to a Panasonic CF25 field computer running the U. S. Department of energy (DOE) Environmental Measurements Laboratory (EML) M1 software. This software uses internal efficiency calibration factors, attenuation corrections, and angular flux corrections to calculate and report the individual radionuclide specific activities and associated uncertainties. The system is calibrated on a daily basis prior to field measurements.

Appendix 1 shows the results of one-meter measurements at the PM2A area. The Cs-137 values are reported in pCi/g and the uncertainties are at the 1-sigma level. The data is mapped on as shown below in figure 3:

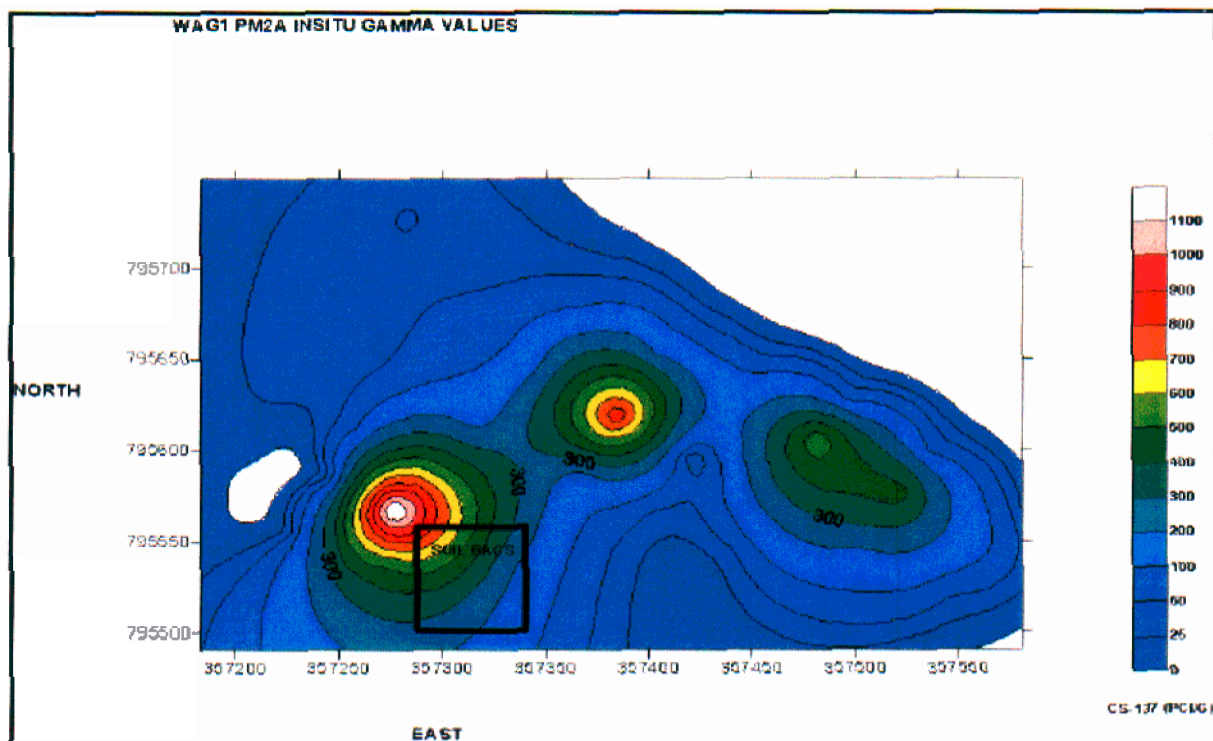


Figure 3:Cs-137 profile at WAG 1-PM2A area

Notice that the areas of elevated Cs-137 occur north of the soil bags and near the areas known as piles 1 and 2. The effect of "shine" or background radiation on the measurements near the soil bags is obvious. The points measured near the soil bags were located in very close proximity to the bags. Values range from 13 to 1256 pCi/g in this area.

Grab Sample Results:

In order to better establish the effect of shine at the PM2A site, samples were taken and analyzed. The samples were collected and placed in plastic sample containers and then analyzed for Cs-137 concentrations using a fully calibrated, NIST-traceable gamma spectrometry system at INTEC. The Cs-137 data are shown in Appendix 1 and are plotted below in figure4:

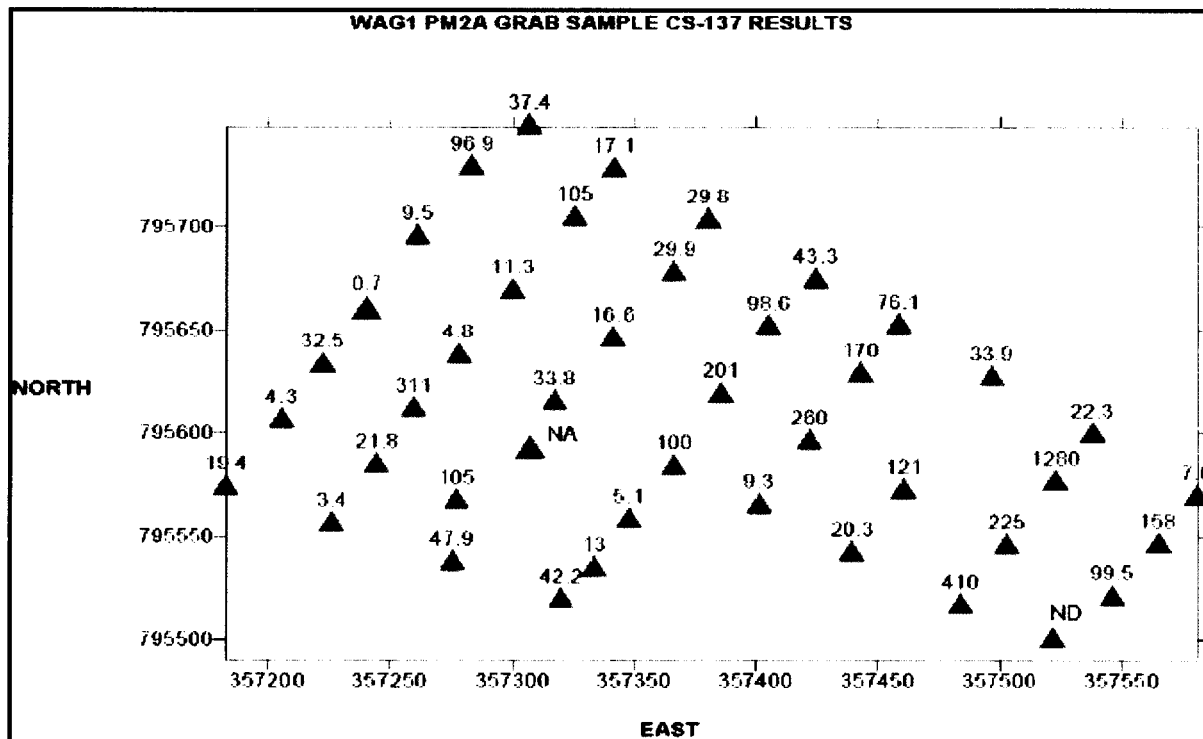


Figure 4: Grab sample results from PM2A area

The figure 4 data shows much lower values of the Cs-137 than the DART measurement results. The grab sample results range from below detection limit to a high value of 1280 pCi/g of Cs-137. This high value is at point number 18, which is near pile1. This location appears in all the figures as a location where hot spots are still present following soil bagging. Note in appendix 1 that the grab sample result for location number 20 is missing. This sample was above the rad limit for shipping and was discarded. In addition, figure 4 points out that the soil bag area has Cs-137 values ranging up to 311 pCi/g. This is much lower than the DART insitu values which were biased by the shine from the bagged soil. Measurement location 34, however, is also missing from the data because this sample was too hot to transport and was discarded. Also, the SAM 935 system was calibrated using the same NIST standard as was used to calibrate the INTEC lab systems. Thirty six of the collected grab samples were counted on the calibrated SAM and a comparison is shown in the summary section of this report.

If we assume that the windblown contamination is spread homogeneously at this site, we can map the grab sample data and interpolate between measurement locations. This result is shown in figure 5.

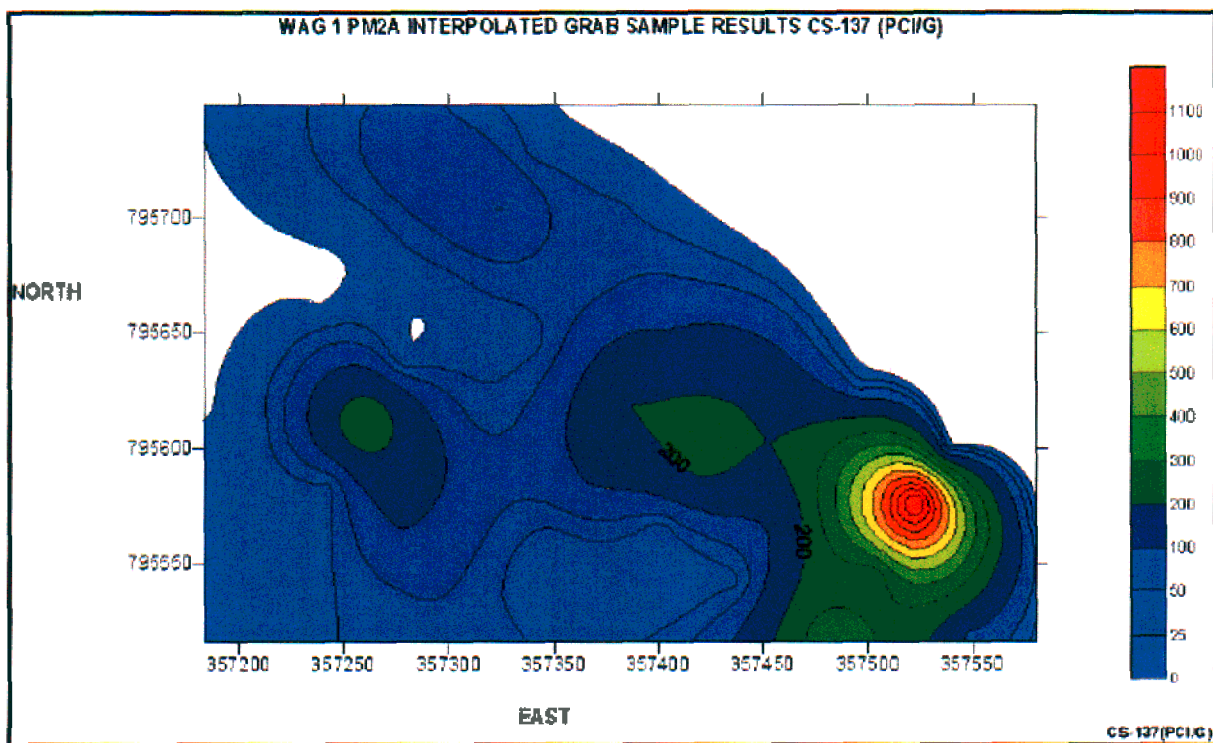


Figure 5: PM2A Interpolated grab sample Cs-137 results

Figure 5 shows that the area near point 18 moving northwest is most subject to hot spots or localized contamination areas. Grab samples taken near the soil bags showed much lower values of Cs-137.

Summary:

Figure 6 below is a summary map of all measurements taken at the PM2A site. The following conclusions are drawn from this data:

1. Most areas of the PM2A site remain above the 23 pCi/g Cs-137 level as determined by both grab samples and insitu gamma spectrometry.
2. The area near points 18-20 is still affected by windblown contamination and hotspots.
3. The soil bags contribute significant shine to uncollimated DART system measurements.
4. The SAM 935 gross counting system appears to be an excellent first pass instrument for scoping a large site such as the PM2A.
5. Most areas of the PM2A except for the soil bag storage area appear to have lower shine contribution following the cleanup of pile 2.
6. Appendix 2 shows results of several statistical comparisons. The results are shown here:

Test	Result	Conclusion	p-value
DART variance Vs Grab sample Variance	f=1.5 f(crit)=1.7	no signif. Difference	.09
DART mean Vs Grab Sample Mean	t=1.5 t(crit)=1.7	no signif. difference	.07
SAM 935 variance Vs grab sample Variance	f=.92 f(crit)=.57	signif. Difference possible..	.40
SAM 935 mean Vs grab sample Mean	t=.19 t(crit)=2.0	no significant difference.	.42

This data shows that there are no statistically significant measurement biases between measurement types (i.e. Grab samples, DART, SAM 935 calibrated for quantitative work)). However, we caution that some biases could be masked due to the very large variances associated with each data set shown in Appendix 1.